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progress to be able now to give in a popular dress an account of its aims, its problems, its methods, and its results. It is fortunate that Professor Wundt, whose name perhaps, more than that of any other person, has become associated with this modern movement, has given his time to a more or less popular exposition<sup>1</sup> of a few departments of this diffuse subject. The development of experimental psychology has been such a rapid one, that already one must be a specialist in one department of it. To some extent Professor Wundt has confined his essays to an account of work done in his own laboratory, while another portion of the book presents views upon those general problems, interesting to every generation of mankind, which seem to him most adequate and scientific.

In an essay on the problems of experimental psychology, he contrasts the method of this science with that of metaphysics, with which it is historically closely connected, and defends it from the attacks and prejudices of its opponents. On the one hand, the metaphysicians raise the cry that it is only 'crude empiricism,' a mere attention to natural phenomena, a lower field of work, perhaps good enough for those who are willing to enroll themselves in such a cause; while the nobler, higher flights of pure philosophy, where every problem finds its solution worked out with a wonderful ease and regularity, are widely open to him. On the other hand, the exact scientists regard this new aspirant for a place amongst the sciences with a suspicious distrust of the justness of its claim. The best answer to the first is to prove to him that many of the problems discussed, *pro* and *con*, by various metaphysical schools, can be brought into the laboratory and solved there with the aid of suitably devised apparatus. The answer to the latter will be a demonstration that within natural limits the same regularity and predictability that characterizes his own work, also holds in experimental psychology. In other words, it is the 'measurement of psychic processes' (the subject of the next essay) that forms one of the main problems.

The beginning of all culture is a clock. Where the conditions of life are so primitive that a time standard is unnecessary, there can be little mental development. For measuring time, man need not invent an apparatus, but has only to learn to tell time on the world-clock, the movements of the heavenly bodies. But it is to be noted that time, though objectively measured, is really a psychic process; for our perception of time is not changed when the clock stops, but is changed when we fall asleep. One by one the measurements of physical

phenomena are required, and last comes the utilization of these physical measurements for measuring the psychic processes. The first time sense is the flow of sense impressions; the last step is to turn back and measure these impressions. Some sort of philosophy or psychology appears early in history; then come the great advances of physics; in the last stage, a psycho-physics.

Perhaps it is only a coincidence that it really was a branch of physical science, astronomy, that performed the first experiment which led to the long series of studies of psychic time. Even a martyr can be pointed out in this cause; for it is told that an observer at Greenwich, whose observations were unusually slow, was often boxed on the ears for this peculiarity, and afterwards discharged. Twenty years later Bessel saved the honor of our martyr by pointing out that each person had a 'personal equation' of his own; that it took an appreciable time to record an observation after it was made, which time differed in different individuals. If we were asked to press a key as soon as we saw an expected flash of light, it would seem to us that the reaction was instantaneous. But still ordinarily it takes from an eighth to a sixth of a second. About a half to a tenth of a second is taken up in central brain processes, while the rest is used in conducting the impression to and from the brain. If, instead of reacting when we saw the light, it was agreed that the reaction should take place only after the color of the light had been perceived, the additional time necessary for perceiving this color might be called the 'distinction' time, and would vary from a twentieth to a fiftieth of a second. In this way the time necessary for hearing syllables, words, seeing colors, figures, pictures, letters, and so on, and understanding them, is open to measurement, and the relative time required for these operations marks their complexity. Again: we can agree, that, if you see a blue light, you are to react with the right hand; if a red, with the left. Here is, first, the time for perceiving a light already measured, then the time to distinguish its blueness or redness, also measured, and then the 'choice' time necessary for selecting the appropriate hand for the color seen. This last psychic process takes about as long as the 'distinction' time. Of course, it depends on the number of reactions from which the choice is to be made. If it is one of two, the time would be a tenth of a second; if one of ten (say, the ten fingers), the time would be half a second. A rather curious result of these observations is, that it takes almost as long to perceive a single letter as it does to perceive a one- or two-syllable word, which shows that the word is perceived as a whole, not as a combination of letters, — that it is

<sup>1</sup> *Essays*. By W. WUNDT. Leipzig, Engelmann, 1885.

the psychic unit. The next step takes us still further into the nature of mind by measuring the time necessary for one idea to call up another related to it in any way,—‘association time.’ This process is evidently a more complicated one, a higher function, and takes a longer time, about half to three-fourths of a second. Individual differences are very great here, and we are at the beginning of those mental qualities which in their extremes distinguish the genius from the dullard. Not only the time, but the kind of association, is characteristic of the individual. The direction of one’s associations is as good a clew to his character as can readily be gotten. If we limit the subject to one kind of association, for instance, what the logicians call ‘subsumation’ (that is, for example, if the word is ‘horse,’ the associated word must include horse as ‘quadruped,’ ‘animal’), the time is longer by about a tenth of a second than unrestricted association time.

Another very curious result which was wrought out in Professor Wundt’s laboratory is the peculiar effect of attention, which actually makes you hear or see a thing before the thing is there to be heard or seen. If you are to observe opposite what stroke of a graduated circle an indicator attached to a pendulum is swinging when a bell strikes, then, after the interval between the beginning of the swing and the ringing of the bell has become fixed in your mind, you will anticipate the stroke of the bell, and make it ring a fraction of a second before it really sounds. But a further discussion of this question would carry us too far. It has been shown, that, compared with such motions as light, sound, or electricity, nerve-conduction is slow, and those nerve processes associated with the more complex sensations and perceptions very slow indeed; that by measuring these times we will obtain a graded scale of the complexity of some of the simpler mental processes, and gain a deeper insight into their nature.

This essay has been selected because it represents, perhaps, the more strictly original part of the book better than any other. Most of the others are inspired by new points of view, as, for example, the one on language, which takes its basis from the observations on the development of language in children and deaf-mutes.

From the English side comes an attempt to give in a popular form the results of studying the insane and deranged as far as such study bears on certain peculiar historical and psychological facts.<sup>1</sup> One general topic in which the author is deeply interested is the hallucinations of eminent historical characters. The list of these is so strikingly

large, if one is willing to take into account very small deviations in mental soundness, that it has led to the thesis (old as Aristotle) that genius and insanity are closely allied. But the cases treated by Dr. Ireland are only those in which this hallucination gave character and motive to the life of the individual. The peculiar mental condition of Mohammed, Swedenborg, and Joan of Arc, are graphically and instructively presented: they form a welcome contribution to the psychology of greatness. In this connection may be mentioned a work on genius,<sup>1</sup> recently published, which, though it makes no claims to be, and is not, a scientific book, touches with a somewhat literary motive on this topic. The writer has made a strong statement of the vanities of eminent men; not of men of genius, however, in any proper sense.

Another peculiar malady which the flesh of the great is heir to, is the ‘insanity of power.’ The proposition is, that persons in positions in which all their wishes and whims can be put into deeds at once, are liable to become intoxicated with this omnipotence, and to indulge in morbid and cruel practices. The horrible spectacles which the reign of the Claudian-Julian family of emperors at Rome, reaching the climax in Nero, presented to the world, shows the terrible force of this disease, and its hereditary nature. The reigns of Ivan the Terrible in Russia, and of Mohammed Toghluks in India, are other examples of the debasing effects of unchecked power, while the hereditary neurosis of the royal family of Spain illustrates the special dangers to which these select families are subject.

Another line of interest with Dr. Ireland is the study of the relation of the two sides of the body. As the main motor nerves cross from the brain to the opposite side, we are right-handed and left-headed. This predominance of the left hemisphere of the brain is an indication that the two hemispheres only in part are one, and in part are two. Have we one brain or two brains? is, then, not at all an unnecessary question. The peculiar phenomenon of mirror-writing (i.e., of writing from right to left, so that when reflected in a mirror it appears normal), which appears in children and some forms of insanity, has attracted notice to this question. The results as yet are not very definite. Other psychological curiosities, such as sympathetic insanity, which makes whole families go insane at once, peculiar fixed ideas, and so on, are treated in a popular way. The book will not say much that is new, but gives in a very readable form an interesting account of some of the modern phases of psychological thought. J. J.

<sup>1</sup> *The blot on the brain: studies in history and psychology.* By W. W. IRELAND, M.D. New York, Putnam, 1886.

<sup>1</sup> *Insanity and vanity of genius.* By KATE SANBORN. New York, 1886.